JITTA

JOURNAL OF INFORMATION TECHNOLOGY THEORY AND APPLICATION

A Publication of the Association for Information Systems

Design Science as Design of Social Systems—Implications for Information Systems Research

Andreas Drechsler
Institute of Computer Science and Information Systems (ICB)
University of Duisburg-Essen
andreas.drechsler@icb.uni-due.de

Abstract:

This paper summarizes the current literature on design science research (DSR) in the management field and shows how management DSR can further the DSR discourse in the information systems (IS) field through a novel perspective beyond a focus on the IT artifact and its application context. Based on a review of the management literature, the paper condenses current management DSR into a comprehensive approach. The paper illustrates the benefits of this approach for the IS field by applying it to two typical directions of IS research: traditional IT artifact-centric DSR and DSR for IS/IT management or IT project management organizations. In addition, the paper presents and discusses a novel approach to define IS DSR artifacts, more differentiated views of artifact relevance, and the impacts of artifact instantiations.

Keywords: Management Design Science, Organizational Design, Social Design, Socio-Technical Design, Artifact, Relevance.

Volume 14, Issue 4, pp.,5-26, December 2013

Marcus Rothenberger acted as the Senior Editor for this paper.

JOURNAL OF INFORMATION TECHNOLOGY THEORY AND APPLICATION

INTRODUCTION

While there is an ongoing discussion about the role and methodologies of design science research (DSR) in the information systems (IS) field, Gregor and Hevner (2013) characterize the current state of IS DSR as focusing on designing socio-technical IT artifacts. This constitutes an evolution from earlier perspectives on IS DSR, where, for example, Hevner et al. (2004) suggest "not [to] include people or elements of organizations" (p. 82) in their definition of the IT artifact. Therefore, we can conclude that IS DSR's focus has shifted gradually over time from viewing IT artifacts with a solely technology-centric perspective to viewing them with an increased consideration of their organizational or social context(s).

But there are also positions that criticize this focus on IT artifacts—with or without consideration of their social contexts—altogether. For example, Alter (2003) and Nunamaker and Briggs (2012) propose shifting the perspective of IS research even further away from IT artifacts toward systems in organizations or information systems to create value with information. Furthermore, socio-materiality notes that the material IT artifact and its social context are intertwined and difficult to isolate analytically (Leonardi and Barley 2008). In addition, explanatory research in IS has traditionally emphasized the organizational and social aspect of socio-technical systems (Frank et al. 2008). Furthermore, theories from social science are generally regarded as candidates for kernel theories in the IS field (Walls et al. 1992). In this light, it appears worthwhile to explore IS DSR through a perspective in which IT artifacts constitute only certain elements of a socio-technical system. With this perspective, we can discover how such a—arguably radical—reversal of viewpoint may benefit IS DSR. While such a perspective concerns fields other than the IS field (such as management and organization studies), this is a consequence of the inherently inter- and transdisciplinary nature of the IS field and has the potential to advance and strengthen it further (Galliers 2003). Therefore, I use the term "IS DSR" in this paper for design science research contributions and endeavors – past and future – that fit at least partially into the IS field's scope.

In the last decade, both the IS field (Benbasat and Zmud 1999) and the management field (Starkey and Madan 2001) have discussed rigor, relevance, and research methods. Like in IS, these fields developed DSR approaches (Romme 2003; van Aken 2004) and subsequently discussed and evaluated them (Pandza and Thorpe 2010). These approaches are for designing not information systems, but rather social systems, such as organizations. For the IS context, March and Vogus (2010) succinctly review the foundations and current examples of management DSR. However, they do not cover the extensive works of (for example) van Aken, one of the most prominent DSR scholars in the management field. There also have been several new developments in management DSR since March and Vogus published their review. And while some scholars have applied some basic ideas of management DSR in some publications in IS already (e.g., Hrastinski et al. 2008; Carlsson 2010; Carlsson et al. 2010), they applied only selected ideas and did so in the context of specific DSR projects. A comprehensive transfer of concepts and approaches from management DSR to IS DSR and a discussion of implications for key fields of IS research beyond the interests of singular research endeavors are missing in the current literature. This paper provides such a transfer and subsequent discussion.

CONTRIBUTION

This paper contributes a novel perspective to and raises several implications for specific issues in the ongoing discourse on IS design science research (DSR). The novel perspective in form of DSR for the design of social systems is based on the current DSR theories and practices in the management field. It is reviewed and summarized in form of a comprehensive DSR approach for social / socio-technical systems. Here, a very high level of compatibility is found between the current states of the two DSR discourses.

Based on this, this paper shows how key findings from the management DSR contribute to the respective DSR discourse in IS in three areas: 1) the view of artifacts as tangible or intangible social facts, 2) a differentiation between conceptual, instrumental, and legitimate practical relevance of abstract artifacts and their instantiations, and 3) the view that artifact instantiations and implementations in practice serve to initiate and guide path-dependent or path-creating change processes in social systems, instead of constituting a mere engineering-like application. The approach for management DSR is also applied in detail to two specific directions of IS DSR: 1) the traditional one: designing IT artifacts, and 2) a novel one: DSR for management systems for the management of IS or for IT projects.

For IS researchers designing IT artifacts, the paper offers a novel perspective on artifacts, their forms of relevance, and the consideration of their social or organizational context during artifact design, instantiation, and evaluation. For IS researchers with research interests in IS/IT management or IT project management, it shows a comprehensive way for conducting DSR in these areas.

As a foundation, I first review the literature on the foundations of management DSR. With this basis, I then condense current management DSR literature into one comprehensive approach. I then contrast this research with the current state of the discourse on DSR in IS and highlight key contributions the management DSR literature can make to the IS DSR discourse. Afterwards, I show concrete implications of the management DSR perspective for the two most suitable areas of current IS research: the first area is the "classic", IT artifact-centered DSR; and the second one comprises conducting artifact-centered DSR for the areas of IS/IT management and IT project management. Finally, I discuss the limitations of the approach and further research possibilities.

The design of socio-technical systems is not only the domain of management and IS DSR, but also of action research in the specific form of action design research (Sein et al. 2011). However, some scholars have critically characterized action research as "seemingly similar, but decisively dissimilar" to design science (Iivari and Venable 2009). Specifically, Iivari and Venable identify several possible ontological, epistemological, methodological, and ethical differences between action research and design science research. At the same time, they also outline that the two can be applied together if researchers and their action research clients from organizations in practice consciously align the paradigmatic foundations and goals of action research and design research. Due to these dissimilarities, action research in the context of IS DSR is not covered further in this paper.

DSR IN THE MANAGEMENT FIELDS

This section reviews the current management DSR and summarizes it into a comprehensive approach. The section beginning "Fields of application" actually applies and transfers each issue presented in this section to IS DSR.

Background and foundation

Historically, in the early decades of the 20th century, organizational research (e.g., by Frederick W. Taylor in the US, Henri Fayol in France, and Heinrich Nicklisch in Germany) was largely design oriented. These authors all took a very rational stance on organizational design. Later on, explanatory and empirical research largely supplanted this rational and design-oriented perspective (Frank 2001). At the end of the 20th century and the beginning of the 21th century, however, scholars called for increased practical relevance of both management research (Starkey and Madan 2001) and teaching (Bennis and O'Toole 2005). Interestingly, this debate took place at about the same time as the debate about the need to increase practical relevance of IS research (Benbasat and Zmud 1999; Davenport and Markus 1999). Specifically, Starkey and Madan (2001) point out that, in their perspective, management research outcomes at the beginning of the 21st century had little relevance for stakeholders. As a remedy, they suggest that management research scholars should produce more knowledge that is applicable in a practical context and that tends to be of a transdisciplinary nature. Following Gibbons et al. (1994), they call this type of knowledge "mode 2 knowledge", as opposed to "mode 1 knowledge", which represents solutions to problems of largely academic interests that are specified inside the academic community. In a direct response, however, Grey (2001) criticizes Starkey and Madan's perspective as too narrow and too simplified in three regards: 1) in the context of universities producing knowledge, the two modes of knowledge do not adequately describe reality, 2) "mode 2 knowledge" does not reflect on or critique current theories or practices, and 3) Starkey and Madan use the term "relevance" in a too-narrow way in the sense of "relevance for industry at the time of knowledge production".

Nicolai and Seidl (2010), based on an extensive literature review and analysis of papers from top tier management journals, have advanced the relevance debate in management research further by differentiating between three forms of relevance of management research findings and outcomes: instrumental relevance, conceptual relevance, and legitimative relevance. As being of instrumental relevance they characterize research outcomes in the form of 1) schemes for decision support (e.g., matrixes, flow charts, and checklists), 2) technological rules / recipes to support and guide decision-making, and 3) forecasts. As being of conceptual relevance they classify 1) linguistic constructs (metaphors or phrases that change thinking and communicating about reality), 2) contingencies (showing new possible ways of acting), and 3) causal relationships between phenomena. As being of legitimative relevance they include 1) the credentialization of managerial action by applying scientific techniques and 2) rhetoric devices for justifying managerial action to third parties. They found that the majority of papers they analyzed uncovered new causal relationships between phenomena (49%) or provided technological rules for managerial action (40%). Because they regard generalized and abstract technological rules as being of limited utility to solve highly context specific managerial problems in practice, they see a conflict between scientific rigor and instrumental relevance for practice. For conceptual relevance, they do not see such a conflict because the novelty and surprise of new causal relationships conform to the goals and expectations from both science and practice. Hence, they suggest that management scholars should emphasize conceptual relevance in order to give decision-makers further insight into specific decision situations and to contribute to more reflected decision-making. This advice is especially striking because they effectively recommend emphasizing exactly the kind of research that started the whole relevance debate in the management field: explanatory research to uncover new causal relationships.

Kieser and Leiner (2009) are even more critical of the notion that the gap between research rigor and practical relevance of management research outcomes can be bridged at all. They take a systemic-constructivistic perspective and regard academia and practice as two distinct self-referential and operationally closed systems with differing inner logics. In their view, these two systems cannot communicate directly; they can only irritate each other. Nicolai (2004) calls this "applied science fiction" instead of a controlled flow of information between the two systems. In contrast, Hodgkinson and Rosseau (2009) explicitly refer to DSR when illustrating successful ways of transferring knowledge between management research and practice without giving up the values of rigor and abstraction. Fendt and Kaminska-Labbé (2011) based on an extensive review of the 20th century literature (albeit with an additional focus on action research in addition to management DSR), come to the same basic conclusion. Finally, Avenier (2010) illustrates how, in a constructivistic perspective similar to Kieser and Leiner (2009), DSR can indeed serve to bridge the rigor-relevance gap in the management field. He points out that abstract knowledge in the form of technological rules and artifacts does not lead to immediate managerial action (as the term "instrumental relevance" would imply). Instead, he highlights that any research findings—including technological rules and artifacts—serve to "irritate" practitioners in a positive way first. Specifically, technological rules initiate processes of reflection and enlightenment in practitioners' minds and stimulate their creativity in the decision making process before any managerial action is carried out. Thus, despite its criticisms, we can conclude that DSR is indeed a possible way of overcoming the rigor-relevance gap in management research. At the same time, it should not be regarded as a simple "bridge" between academia and practice that allows a direct "delivery" of readily applicable solutions.

To sum up the state of the management DSR field, we can identify four major research streams. Pandza and Thorpe (2010) provide a brief characterization of three of them. First, researchers such as Weick (1989) emphasize an approach revolving around imaginative, but disciplined, theorizing about organizational phenomena. A second group strives to balance theoretical rigor and practical relevance; for example, Hodgkinson et al. (2001) and Pettigrew (2001), while still focusing on theoretical and explanatory research. And third, researchers such as van Aken (2004) and Romme (2003) emphasize practical relevance through their DSR approaches for management DSR while still upholding scientific rigor at the same time. Avenier (2010) calls this "ostinato rigore" (which he names as Leonardo da Vinci's favored motto that means obstinately striving to be as rigorous as possible). A fourth one they do not cover was established by Sarasvathy et al. and takes a design-oriented perspective on entrepreneurship (Sarasvathy 2001, 2004; Sarasvathy et al. 2008). Since it includes a market-oriented perspective (e.g., the intentional design of future markets and market niches) and a resource-based perspective (design of business models and newly founded firms), it is not easily adaptable, if not incommensurable, to the strongly resource-oriented IS DSR. Therefore, the subsequent section is based on current literature in the third research stream which, as shown later, fits well into the current IS DSR discourse.

Current state of DSR in the management field—a comprehensive approach

This section presents a comprehensive DSR approach for social systems based on current literature in DSR research in the management field. It complements March and Vogus' (2010) review mentioned in the introduction because their focus is more on the general discourse and less on the methodical side. Henceforth, I regard organizations—or any parts thereof—as instances of the more abstract term "social system". Because an organizational perspective is common in both the management and the IS field, this will aid transfer between the two fields later on. Such a perspective is assumed in the remainder of this paper unless otherwise noted.

The approach described in this section is mainly based on the work of van Aken (2004, 2005, 2007), van Aken and Romme (2012), Denyer et al. (2008), and Tranfield et al. (2006). The subsequent paragraphs expand it with other research where applicable. Besides the sources mentioned in this section, no other significant contributions to an approach for management DSR could be found in the literature. The approach itself is grounded on Simon's (1996) "Sciences of the Artificial" and Bunge's (1967) work about technological design rules. Figure 1 provides a visual summary of the approach.

Any management DSR effort should start with classes of real-world problems or actors' goals (van Aken 2005). The artifacts should aim to improve the organizational reality by solving the problems or reaching the goals (van Aken 2007). Ideally, the artifacts should be applicable beyond a singular case and also contain a solid, scientific foundation.

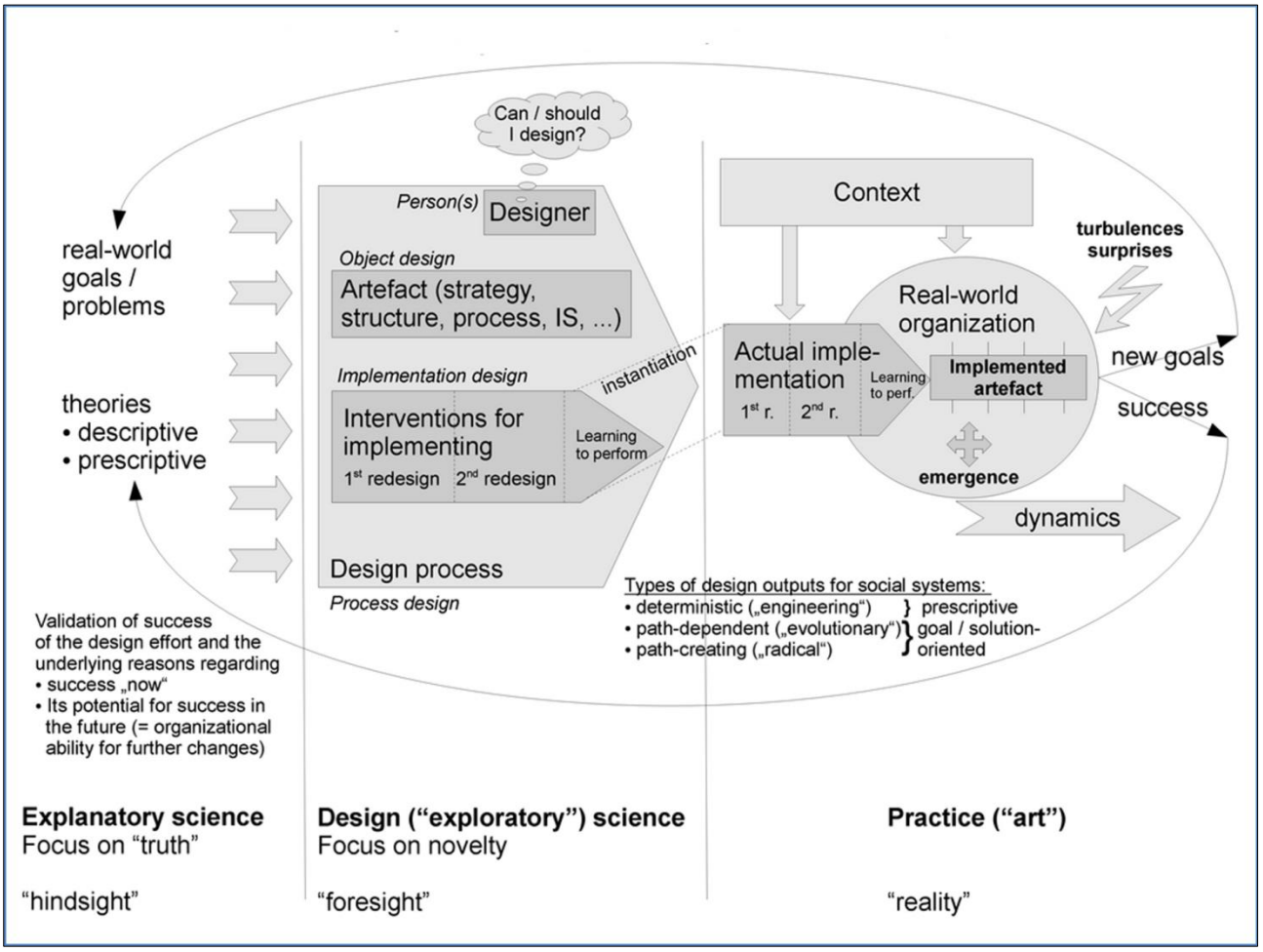

Figure 1: DSR process for management artifacts (visual summary of van Aken (2004, 2005, 2007), van Aken and Romme (2012), Denyer et al. (2008), and Tranfield et al. (2006)

The input for the DSR process is provided by theories of the explanatory sciences (Denyer et al. 2008). Here, van Aken (2004) distinguishes between two types of theories: descriptive theories that contain "truths" about the "real world", and prescriptive theories that contain "truths" about theory-based and empirically validated heuristic design rules (technological rules). However, these rules should not be causal input-output-(IO) rules ("If X, then Y"). Instead, he suggests design rules where the final result is triggered by certain mechanisms, and where the mechanisms, in turn, are triggered by organizational interventions. The suitability of the interventions to trigger the mechanisms and deliver their intended results is dependent on the specifics of the organizational context. Denyer et al. (2008) call this kind of design rules "CIMO rules" ("context-intervention-mechanism-outcome"). They give the following, simplified example for such a CIMO rule: "If you have a project assignment for a geographically distributed team (class of contexts), use a face-to-face kick-off meeting (intervention type) to create an effective team (intended outcome) through the creation of collective task insight and commitment (generative mechanisms)" (Denyer et al. 2008, p. 396). The concept of CIMO rules is based on the work of Pawson (2006) and Pawson and Tilley (1997).

The reason for this explicit context-dependency is that organizations are both unique in character and situation at any point in time (Romme 2003). Additionally, organizations are continuously concerned with phenomena such as change, emergence, turbulences, surprises, and so on. These phenomena occur in the organizations and their environment (their context) (Tranfield et al. 2006). These phenomena make heuristic CIMO rules more suited for management DSR than strictly causal IO rules because they will not become automatically invalid simply due to a sufficiently differing context. In other words, their "truth"—or rather, their utility—is also context dependent. This context-specific nature is also a key reason that a tautological transformation from explanatory statements from theories to context-specific design rules yields outcomes that are of little utility (Bunge 1967).

Van Aken (2004) emphasizes that sufficient rigor can only be achieved when the design rules are not only based on theories, but are also repeatedly validated in the field. New and different contexts (and subsequent validation through appropriate field tests) can always lead to further refinement and extensions of a rule. Generally, a rule can consist of a single sentence or an entire book, depending on its complexity and the amount of differentiation in the four elements of context, interventions, mechanisms, and outcome (van Aken 2005). Both descriptive and

Journal of Information Technology Theory and Application

prescriptive theories can only make statements about the past ("in hindsight", or "ex post"). Both kinds of theories can be developed and enhanced in various ways. These ways include "disciplined imagination" (Weick 1989), systematic review (Tranfield et al. 2003), and especially conducting repeated quantitative and qualitative studies concerning the success of design efforts (van Aken 2004).

The process for DSR itself is divided into the design of the design process itself ("process design"), the design of the actual abstract management artifact ("object design"), and the design of an abstract implementation process ("implementation design") to embed the object design into a specific instance of an organization (van Aken 2004). Additionally, the person(s) who design are also relevant research subjects. Before undertaking a management DSR project, they should ask themselves whether it is possible and feasible to do so, depending on the real-world situation (the context) (Tranfield et al. 2006).

An abstract object design may contain all elements of a future organizational reality that help an organization to reach its initial goals or solve its initial problems. For the accompanying (abstract) implementation design, van Aken (2007) suggests to divide it into three phases: two redesigns of the abstract object design followed by a final phase of "learning to perform". In the first redesign phase, the abstract object design needs to be formally adapted to the specific organization and its context. The second phase allows relevant organizational actors (managers and users, for example) to further adjust the object design (in deliberate and emergent ways) during the introduction process. These adjustments continue while everyone "learns to perform" until the artifact is fully embedded inside the organizational routines.

Romme (2011) provides further insight of the nature of organizational artifacts and the process of "artifaction" inside an organization after the introduction of new artifacts through interventions. Note that Romme does not explicitly share van Aken's idea of object designs, but instead focuses on – again, in van Aken's diction – the implementation design. However, the general ideas are of a sufficiently abstract nature to be applicable to both kinds of artifacts. For Romme, organizational artifacts are tangible or intangible, socially-constructed "facts" (e.g., for example "products, services, organizational structures, organizational identities, business strategies, multiuser networks, management tools, projects, and discourses") (Romme 2011, p. 12). Applied to abstract object designs, this means that they can contain a wide range of tangible or intangible social facts of a future organizational reality. The accompanying artifaction process in organizations Romme describes takes place in four (not necessarily sequential or mutually exclusive) modes: fabrication, displacement, reinterpretation, and ascription. During the fabrication phase, a new artifact is socially constructed and introduced to the organizational reality. As an example, Romme uses the artifact "dress code" in a newly founded IT firm. In this situation, the initial fabrication of the "dress code" artifact could either happen as an emergent process (what the employees tend to wear to work regularly), or, alternatively, management could prescribe a certain dress code right from the start. An established dress code ("jeans and T-shirt") could then change for a certain context ("sales pitch") and, hence, be displaced by a new dress code artifact "suit and tie" for this context. Reinterpretation now means changing the meaning or function of the artifact: For example, potential clients could interpret the initial dress code as lack of respect, which, in turn, could lead to the prescription of a more formal dress code for employees. This is opposed to ascription, which is about deliberately changing the perceived properties associated with the artifact. In the example, management could attempt to change the dress code to a more formal one independent of the situational context in an attempt to enhance and display the business orientation of the IT firm through a change of the artifact. As such, we can see that this perspective on artifacts takes place more on the level of mental (or even language-related) concepts than on a purely physical or factual level. Beyond this rather abstract perspective, no further specific discussion could be found in the literature of management DSR about the nature and the constitutive elements of organizational or management artifacts.

The actual instantiation and implementation of the abstract artifacts is partially regarded as an "art" of practitioners (Tranfield et al. 2006). Practitioners need to take their specific organization and their specific context into account when instantiating and adapting the abstract object and implementation designs in order to be able to successfully integrate them into their organization. In a singular case, context factors, organizational dynamics, and phenomena of emergence influence whether such an implementation effort eventually leads to success or failure. The same factors may also lead to new goals and problems, which, in turn, may lead to a continuous cycle of evaluation, design, and implementation (Garud et al. 2008).

Pandza and Thorpe (2010) differentiate further between deterministic, path-dependent, and path-creating outcomes of such DSR-induced instances of organizational change. In a deterministic perspective, the implementation of organizational change is seen as a mere engineering problem to realize an intended future state of an organization through prescriptive measures. Path-dependency occurs when an organization changes incrementally based on the decisions it has made in the past. In contrast, path-creation occurs when the organizational radically redesigns itself. This distinction applies both to the designer's intention during the design of the abstract artifacts (prescriptive design, incremental improvement, or "revolutionary" artifact?) and to the instantiation in a particular case in practice. This

differentiation is necessary because the implementation design explicitly allows (or even requires) adaptation and redesigns of the abstract object design during its instantiation. In other words, only the designers' decisions determine whether a design effort in a particular instance leads to a path-dependent (incremental) or path-creating (radical) change. Pandza and Thorpe also regard the deterministic or engineering-oriented perspective as unsuitable for management DSR due to the specific nature of organizations, which are both unique in character and situation at any point in time (Romme 2003) and also concerned with phenomena such as emergence and surprise (Tranfield et al. 2006).

The success of such a design effort can manifest itself itself in an organization reaching its goals or solving its problems "now", and also in it sustaining and increasing its ability to solve problems or transform itself in the future (Garud et al. 2008). Van Aken (2004) further differentiates between "alpha tests" and "beta tests": alpha tests are the repeated instantiation of a management artifact in similar contexts, while beta tests are about subsequently applying them to differing contexts. The goal of these tests is to reach a broad and differentiated validation of the design artifact and the underlying design rules while deliberately considering the instantiation contexts. In addition, other designers' perspectives should serve to overcome the limitations of the perspectives of the designers of the initial artifacts.

Eventually, these tests will lead to a validation and an expansion of the underlying theoretical foundations, which, in turn, will benefit further design efforts. Of specific interest here are mechanisms that aid or hinder the implementation of a certain design rule and contexts in which certain elements of artifacts (and the underlying design rules) turn out to be inapplicable. Any repetition of this cycle for a single group of artifacts (object design and accompanying implementation design) leads to further differentiated design rules. In the end, differentiated and validated design rules offer potential solutions for a wide range of problem situations and contexts. This is not only beneficial for further efforts (van Aken 2004) but also allows justification of a design rule (and, in turn, artifacts) through "theoretical saturation" (Eisenhardt 1989) without a theoretical-deductive justification. This does not mean, however, that even the most differentiated design rules and widely justified artifacts allow a forecast about success or failure of an actual design effort. Furthermore, there can never be a "proof" of a design rule in the strong mathematical sense.

In an overall perspective, this management DSR approach builds on ex-post ("hindsight") explanations from descriptive theories in order to create novelty "ex-ante" (or "in foresight"). It aims to deliver a combination of valid design propositions – which manifest themselves in artifacts – beyond singular cases or applications (Tranfield et al. 2006). The evaluations of the instantiations then provide the link back to the underlying foundation of descriptive theories.

In a recent development, management DSR has been placed in the wider context of evidence-based management. The basic idea of evidence-based management is to utilize the best available findings from research and connect them with organizational facts, indicators, and metrics from the application context in order to support the critical and reflective judgment of decision-makers in practice, while at the same time paying attention to ethical implications of the decision situation (Rosseau 2012). DSR is seen here as one means to achieve evidence-based management, where the empirically validated artifacts and design rules in their context are treated as one instance of evidence to inform and guide management decisions (van Aken and Romme 2012).

Limitations of the current management DSR discourse

While the review and summary of the approach in the previous sub-section could draw from a rather extensive literature base, note that there are very few instances of an actual application (see van Aken and Romme (2012) for an exception). Publications about actual instances of management DSR projects utilizing other approaches are likewise scarce. One possible reason for this is that the design science paradigm is not a part of the management research "mainstream". Most of the relevant literature stems from a few special issues in certain journals. Additionally, most research remains on a theoretical and conceptual level. Discussion on DSR in the management field also are often superseded by more general discussions around rigor versus relevance. In these, DSR serves just as an example of a way of conducting more relevant management research. Additionally, Pandza and Thorpe (2010) warn against an overly deterministic, "engineering-like" interpretation of the design metaphor in the light of the design object "organization" / "social system", which is complex, dynamic, and impossible to fully grasp for (potential) designers (i.e., practitioners and researchers).

FIELDS OF APPLICATION OF MANAGEMENT DSR FOR THE IS FIELD

The following sections discuss the implications of the foundations and the previously presented approach for management DSR in the IS field. The first section identifies similarities and differences of management DSR to the current discourse on DSR in IS. The second section highlights specific contributions of management DSR to the

DSR discourse in IS. Afterwards, the implications of such a perspective for "classic" IT artifact-centered DSR in IS are discussed in detail. The fourth and final section covers DSR of management systems for IS/IT management or IT project management.

Compatibility of management DSR to the current state of the IS DSR discourse

In an overall perspective, many of the previously described characteristics of management DSR are similar to the current DSR discourse in IS. This is especially striking because there is (based on mutual citations) limited evidence that the two discourses (which largely occurred in parallel) were closely aware of each other.

In the management DSR approach described above and visualized in Figure 1, the high-level triad of theoretical foundation, design work, and practical evaluation is there to be found, which also forms the cornerstone of IS DSR (Hevner et al. 2004; Hevner 2007). The same applies to an integrated perspective of explanatory and design research as Gregor and Baskerville (2012) propose for IS DSR as well. The similarity extends further to the existence of different schools following the same paradigm of DSR: there is an artifact-centric school following van Aken with his "object & implementation design" idea and a school less focused on artifacts but theoretically-validated interventions (Romme, for example). Gregor and Hevner (2013) identify a similar division of two "camps" in IS DSR: artifact-oriented and design-theory-oriented. Furthermore, van Aken's distinction between descriptive and prescriptive theories mirrors Gregor and Hevner's (2013) distinction between descriptive and prescriptive knowledge.

Likewise, both fields make distinguish between theories, artifacts, and an intermediate step in between. However, this intermediate step is to be found under different names. In management DSR, it is called CIMO rule as mentioned above, while, in IS DSR, the terms justificatory knowledge (Gregor and Jones 2007), DREPT (Kuechler and Vaishnavi 2012), or design knowledge (Fettke et al. 2010) are used. In addition, both DSR variants highlight the important difference between abstract artifacts and context-specific instantiations (Gregor and Jones 2007), and the general importance of an (IT) artifact's context (Benbasat and Zmud 2003). Carlsson et al. (2010) has adapted the concept of CIMO rules for IS research. He expanded it to PIMCO design propositions to specifically include an IS intervention and a separate problem situation in addition to a general context description. Carlsson (2007) also draws a connection between his view on IS DSR and van Aken's distinction between object design, implementation design ("realization design" in his paper), and process design. However, Carlsson applies a somewhat differing perspective. First, he speaks only of designs "IS professionals" make, while the designers in the management DSR approach described in the previous section explicitly include researchers to design abstract artifacts. Second, for him, the object design is about the design of the IS intervention mentioned above that includes the design of an IT artifact. In contrast, the object design in the management DSR approach is understood as a blueprint of a possible future organizational reality and the interventional aspect is highlighted in artifact-independent design rules that serve to ground artifact design decisions in theory. Apart from these two aspects, his views of the implementation design and the process design largely match the views set forth in the previous section.

Key elements of the management DSR approach also match McKay and Marshall's (2007) call to consider the socio-technical context involving researchers, practitioners, and users during IS DSR. The role of designers as agents and the general issue of social design has been discussed by Venkatesh (2008). The need for practical artifact evaluation is stressed in both the management and IS fields (van Aken 2004; Pries-Heje et al. 2008), as is the need to be as rigorous as possible (Hevner et al. 2004; Hevner 2007)—or, in other words, to follow the motto of "ostinato rigore" (Avenier 2010). Kuechler and Vaishnavi's (2008) call to not view IS DSR as a "hard" engineering practice is echoed by Pandza and Thorpe's (2010) critique of management DSR. Pandza and Thorpe extend this critique by specifically distinguishing between path-dependent and patch-creating outcomes of management DSR.

While there is—as discussed in the section beginning with "Current state of DSR in the management field"—no universally accepted definition of the nature and purpose of a management artifact, the idea of van Aken's "object design" artifact is to design a possible, future organizational reality. This conforms to the call by Frank (2009) to design possible worlds as goal of IS research. The wider perspective on designing management or organizational artifacts echoes the perspective proposed by Alter (2003) for the core of the IS field to expand the perspective beyond an IT artifact focus to understand and design socio-technical systems in organizations. It also matches the recent suggestions to shift the focus toward "understand[ing] and improv[ing] the ways people create value with information" by Nunamaker and Briggs (2012, p. 20).

The perceived necessity of a management-oriented perspective on DSR is even mentioned in passing in seminal IS papers. For example, Davenport and Markus (1999) regard the implementation of an information system as a special case of an organizational intervention and its evaluation as an important – yet at that time not highly valued – topic of IS research. Hevner et al. (2004) explicitly mention "organizational design activities" indirectly linked to "information systems design activities"—the area they focus on—by means of an adapted strategic alignment model.

From an even wider perspective, the recent developments in management DSR toward evidence-based management are mirrored in a few recent IS papers concerning evidence-based design of information systems (Goeken 2011; Oates 2011).

In sum, while taking a different perspective (design of social / socio-technical systems instead of IT artifacts), the advances in the management DSR discourse largely match the advances in the IS DSR discourse in recent years. In other words, there is a very high level of compatibility between the current state of management DSR and DSR in the IS field. Hence, there are no fundamental barriers impeding a transfer between the two fields. Specifically, the management DSR approach is complementary to IS DSR in two ways: 1) in management DSR, the IT artifact and its application context (the core of IS DSR) form potential parts of the object design as elements of possible, future organizational realities; and 2) the management DSR approach proposes not only to think of an abstract object design (of which IT artifacts are part of, as just mentioned), but also of an implementation design specifying ways to adapt and customize it to a specific application context. This complementary view on IT artifacts is further elaborated on in the section "Design of IT artifacts as future part of organizations".

However, beyond these complementary natures of management DSR and IS DSR, there are also a few issues raised in management DSR that have received less attention in the IS discourse so far. The subsequent section highlights those that I regard to be of specific relevance for IS DSR and discusses implications.

General contributions to the current DSR discourse in IS

First, the three forms of relevance Nicolai and Seidl (2010) distinguish between—instrumental relevance, conceptual relevance, legitimative relevance—can contribute to the discourse on the practical relevance of IS research outcomes (Benbasat and Zmud 1999; Davenport and Markus 1999; Kock et al. 2002) as follows: type I to IV IS theories (Gregor 2006) should be judged in terms of their conceptual relevance. In contrast, for DSR research outcomes – design artifacts, type V theories (Gregor 2006, and rules—their instrumental relevance is of primary interest. Here, the legitimative relevance of both types of IS research outcomes—which Nicolai and Seidl (2010) characterize as a somewhat latent type of relevance – adds a third perspective on relevance that has not been at the center of attention in the respective IS discourse before. This is an issue that is worthwhile to explore in IS research in the future.

However, the constructivistic lens on DSR by Avenier (2010) shatters Nicolai and Seidl's (2010) relevance distinction. He highlights that DSR outcomes also effectively "just" inspire and guide the decision processes and actions of practitioners and, hence, should also be judged based on their conceptual relevance. This is also a novel perspective on DSR research outcomes. This raises the question, however: how well are IS design artifacts, theories, and rules suited to actually inspire? Specifically, can IT artifacts as tangible and not easily adaptable artifacts really inspire, or are they a special case of DSR outcomes that always only have to be of an instrumental relevance?

In the absence of empirical evidence about the "inspirational power" of IS DSR artifacts in practice, the answer lies partially in another novelty of management DSR when viewed from an IS DSR perspective: the "prescribed duality" of having an abstract object design and an accompanying abstract implementation design. As mentioned before, the latter one shows an artifact-specific way to customize the abstract object design artifact and introduce it into the organization for a specific application instance. Following Avenier's (2010) view, the abstract artifacts now serve to inspire practitioners whether the artifacts have *the potential* to solve their problems (and, hence, are of conceptual relevance). In contrast, only the instantiated artifacts have to prove their instrumental relevance to solve the problem at hand. This distinction shows a way how DSR can indeed overcome the allegedly "unbridgeable" nature of the theory-practice gap (Kieser and Leiner 2009) because the practitioners will usually be the ones responsible for choosing, instantiating, and customizing the abstract artifacts, or, in other words, creating the instances that are of actual instrumental relevance.

Another contribution from the management DSR discourse concerns the nature of artifacts in IS DSR. At present, IS DSR is said to be concerned with socio-technical IT artifacts (i.e., including their context of application) (Gregor and Hevner 2013). Nunamaker and Briggs (2012), however, criticize the concept of the IT artifact in ISR, which can be traced back to Orlikowski and Iacono (2001) and Benbasat and Zmud (2003). Instead, they suggest focusing on information systems that have the purpose to create value with information and that may or may not utilize information technology to do so. In the management DSR literature, van Aken interestingly does not specifically clearly define artifacts in the context of management DSR and coins his own terms "object design" and "implementation design". Instead, it is Romme (2011) who defines artifact in the management DSR context as a tangible or intangible social fact. This definition is very abstract and very broad. His list of examples ("products, services, organizational structures, organizational identities, business strategies, multiuser networks, management tools, projects, and discourses") (Romme 2011, p. 12) illustrates that the definition is indeed meant to be that

broadly encompassing. From an IS perspective, it is striking in two ways: first because it explicitly includes an IT artifact and second because all other elements are typical elements of information systems that can contribute to the creation of value in organizations in the sense of Nunamaker and Briggs (2012). In the light of the issues mentioned at the beginning of this paragraph, we might now ask whether Romme's definition is also suitable for IS DSR, and, if it is, how it can be more operationalized or refined to be more readily applicable to actual IS DSR projects (e.g., by developing a taxonomy of artifacts). All these questions cannot be answered in this paper, but are subject for further research instead.

Romme (2011) also introduces the concept of artifaction and its four phases of fabrication, displacement, reinterpretation, and ascription (cf. the section "Current state of DSR in the management field" for a more detailed description). Romme illustrates the four phases of artifaction by means of an intangible artifact ("dress code", see above). Here, the question is whether the four phases have same relevance for tangible artifact, such as IS or IT artifacts. The artifaction phases of fabrication (the artifact comes into existence of the organizational reality) and displacement (old information systems, routines, and processes are replaced by the new artifact) can be easily applied to the introduction of novel IS or IT artifacts into an organization. It is less clear, however, how a reinterpretation and ascription of IS or IT artifacts or business processes could turn out, and even less what the implications would be for IS DSR. In addition, it would be of general interest to study actual artifaction processes of IS design artifacts in practice through this particular lens and relate them to the four theoretical phases.

Furthermore, in the management DSR discourse, Pandza and Thorpe (2010) distinguish between path-dependent, path-creating, and deterministic or engineering-like outcomes of DSR (cf. the section "Current state of DSR in the management field" for a more detailed description). While this distinction is novel for the IS DSR discourse, it is applicable to it because IT artifacts can be interpreted as a special instance of management artifacts. In line with the view of Kuechler and Vaishnavi (2008), Pandza and Thorpe (2010) dismiss the idea of a "hard engineering practice" and offer two distinct alternatives instead. Beyond the implications discussed above or in the upcoming section, Pandza and Thorpe's dismissal also links back to the distinction between instrumental and conceptual relevance made above. Only an engineering-like view emphasizes the instrumental aspect of artifacts. If instanced artifacts serve instead to foster organizational change of a path-dependent and path-creating nature, they are both of instrumental (to trigger the change processes themselves) and (in particular) conceptual relevance (to inspire and guide the process outcomes). This means a shift of attention from the artifact itself to the change to the organizational context it brings (see also next section). And if the traditional, narrow understanding of an IT artifact is, following Nunamaker and Briggs (2012), indeed to be abandoned, Pandza and Thorpe's view fits well into Nunamaker and Briggs' perspective on information systems in organizations.

Also of interest for IS DSR is Garud et al.'s (2006, 2008) notion to design for adaptability and to increase the capability for intended or emergent change in the future (in contrast to providing an artifact that is optimized for or optimizes a certain status-quo with little regard to possible, future developments). While this is easier said than done for IT artifacts due to their nature, this issue is highly relevant in practice because situations where IT artifacts and their context stay unchanged for a significant amount of time are probably a rare occurrence.

And, last but not least, the IS field does not only concern itself with IT artifacts, but also with organizations to develop (IT project management) or manage (IS/IT management) IT artifacts. Here, management DSR also shows a way to conduct DSR in these two IS sub-fields (see the section after the next).

Table 1 summarizes the main similarities and differences between IS and management DSR based on the current state of the respective literatures.

Design of IT artifacts as future part of organizations

This section shows the specific potential of the previously described management DSR approach for the IT artifact DSR field. After a brief discussion of the general relationship between IT, IS, and organizations in order to draw an explicit connection to the DSR approach from the management field, the remainder of this section follows the elements in Figure 1.

In a definition that is commonly cited, Benbasat and Zmud (2003) characterize the IT artifact as IT applied to support organizational tasks as part of larger task structures, which, in turn, are part of an even larger task context. This means that they explicitly include the organizational context and the purpose of IT in-use. The term "information system" (IS) is commonly used in an even more encompassing perspective to describe socio-technical systems that consist of people and machines (IT optionally among them) and that serve certain business purposes for information processing or communication in order to create value (Nunamaker, Jr. and Briggs 2012). As a consequence, the IT perspective highlights more the technological side of IS, while the IS perspective takes a more inclusive socio-technical stance. Both, however, acknowledge more or less explicitly that it is the human factor in the end, which can

make the application of an IT artifact a useful one, creating value out of its usage in an organization. For the application of the management DSR approach to IT artifact design, the consequence is that the management DSR approach is less relevant when the technological part of an IT artifact is at the center of attention in the design effort, but becomes more relevant the more the human, organizational, or value-oriented part of an IT artifact is of DSR interest. The upcoming application of the management DSR approach to IT artifact design assumes such a scenario.

Table 1: Contrasting IS DSR and management DSR

Aspect	IS DSR	Management DSR
Artifacts	IT / IS / socio-technical artifact or design theory	Object design (management artifact) and corresponding implementation design
Artifact types	constructs, models, methods, instantiations, possible worlds	tangible or intangible social facts as parts of actual or possible future organizational realities (often not explicitly discussed)
Artifact elements	technical and social elements Technical aspects historically emphasized, but social and organizational aspects implicitly or explicitly acknowledged	not explicitly discussed Emphasis on social aspects, technical aspects of social systems only mentioned in passing
Differentiation between abstract artifacts and instantiations	yes	yes
Three-cycle view of theoretical foundation, design, and evaluation	yes	yes
Role of justificatory knowledge	emphasized	implicit (CIMO rules, for example)
Dual emphasis on rigor and relevance	yes	yes
Perspective on artifact relevance	Immediate practical relevance (utility) emphasized	distinguished between conceptual and instrumental relevance
Role of context	assumed as being stable	acknowledged as changing and unpredictable
Perspective on artifact introduction into a social system	not explicitly covered	process of artifaction
Outcome of artifact instantiations	differs between engineering-like application and change perspectives	path-dependent or path-creating change processes in organization
Necessity to design for adaptability to changing contexts	not explicitly covered	acknowledged, but no actual recommendations given
Publications about successful DSR projects, artifact designs, and instantiations	numerous	limited

Similar to management artifacts, designs of IT artifacts also represent potential solutions for classes of real-world problems or goals of organizations (Benbasat and Zmud 2003). From a practical perspective, mostly business or organizational issues – instead of technological issues – should be solved through IT artifacts. Here, Peffers et al. (2007) specifically distinguish between a client/context-initiated start of a DSR process, a problem-centered initiation, and an objective-centered solution. This distinction further reinforces the potential of an adaption of the management DSR approach for relevant IT artifact-centric DSR.

Since the eventual solution needs to contain both technological and organizational elements (otherwise it would probably not be an issue for the IS field), the object and implementation design will likewise have to contain both, and additionally show (abstract, non-instantiated) ways for how the technical and organizational elements can and should interact. For the explanatory sciences, this means that conceptual and empirical research outcomes about technological aspects, organizational aspects, and their interactions are potential sources for formulating design

Journal of Information Technology Theory and Application

rules for designing IT artifacts. While the aforementioned CIMO rules are specifically aimed at formulating design propositions suitable for organizations, Carlsson et al. (2010) have already adapted the CIMO rules to the IS field in the form of PIMCO design propositions. However, they do not specifically relate their design propositions to IT artifacts, so further work is needed on this subject.

Additionally, an IT artifact encompassing a technological and an organizational perspective requires designers well-versed in both fields or, alternatively, experts in each who share a common language and are able to integrate their different viewpoints into the construction of coherent IT design artifacts.

At the end of the design process, the IT artifact "object design" should consist of an abstract design that is potentially suitable to reach real-world organizational goals. Iivari (2007) provides seven roles or functions IT artifacts can have: automate, augment, mediate, informate, entertain, artisticize, and accompany. All these functions can serve as high-level type of goals for the design of IT artifacts. But, even in an IT artifact-focused perspective, the scope of the object design is not necessarily limited to technology. Because off-the-shelf software becomes more and more commonplace (Strong and Volkoff 2010), the object design can not only be an actual software design and implementation for a new kind of information system, but also a reference process model giving guidance on how to collect requirements, choose, and customize appropriate off-the-shelf software (Ahlemann and Gastl 2007). The object design should also include a link to an (abstract) implementation process (i.e., an implementation design). This also implies that the general issue of adaptability and mutability of the abstract IT artifact for a better fit to specifics of later application contexts – both in terms of artifact features and integrative properties to fit into the technical landscape (Allen and Boynton 1991) – is considered during design time. Besides the technical challenges on a software architectural level (Lassing et al. 2003; Williams and Carver 2010), it presents also an economic challenge during design time to weigh the estimated flexibility costs against the additional value the instantiated artifacts can generate during run time due to their better fits to their application contexts.

Similar to object designs, corresponding IS implementation designs will most probably also include technological and organizational aspects of the introduction (or instantiation) of an abstract IT artifact in a specific organization. On the technical side, an implementation design can specify, for example, the necessary and possible ways to customize an object design and to install it into a given IT infrastructure. The organizational side can give a process framework to manage these customization and installation efforts. It also needs to specify processes of generic organizational change management that are specifically tailored to the situational elements of future implementations, which can be assumed to be invariant due to the nature of the IS in question (for example, function or industry dependent). Again, these issues can be covered by reference models (Ahlemann and Gastl 2007).

Each implementation of abstract artifacts means a context-specific instantiation of both object and implementation design. Here, an instantiated implementation design concerns the actual effort to instantiate and customize the corresponding object design (i.e., the IT artifact) for a specific situation, integrate it into a specific IT infrastructure, and introduce it into the organizational processes and routines. Unless specific reasons for a differing approach can be found, it should contain at least the two phases of redesign as specified in the management DSR approach and the final phase where the end users "learn to perform". In other words, the first two redesign phases of an implementation design specifically cover the "adoption" phase, while the last phase provides the bridge between adoption and use of the IT artifact (Davis 1989).

After this, an evaluation phase can and should evaluate the validity of the IT artifact and the underlying design rules. The split between an abstract object and implementation design, together with their explicit context-specific instantiation, allows—through the three steps of the implementation design—an analytical distinction between phases of adoption and usage of the IT artifact in question. This split further allows the possibility of attributing a successful effort to the abstract IT artifact(s) themselves (on the design level) or to the specific customizations during a context-specific instantiation (on the instance level). At the same time, an IT artifact's success becomes context-specific itself. Different organizations (and the actors responsible for introducing the artifact) may have different goals for instantiating and introducing the same abstract IT artifact. This means taking into account context- and stakeholder-specific dimensions of success for measuring success and validity of an IT artifact. Through the extended organizational perspective, any success or failure of an IT artifact can also be influenced by surprises from its environment or internal phenomena of emergence. At the same time, a skilled manager of organizational change can account for such phenomena or deficiencies of an IT artifact during an actual (instantiated) implementation process. In the end, an extended organizational perspective such as this means the possibility of a differentiated analysis of factors contributing to success or failure of an IT artifact. At the same time, such a differentiated analysis can lead to a "dilution" of the term "IS success". Further discussion of this issue is unfortunately limited by the space available here.

Figure 2 (based on Figure 1) summarizes the management DSR approach applied to IT artifact design.

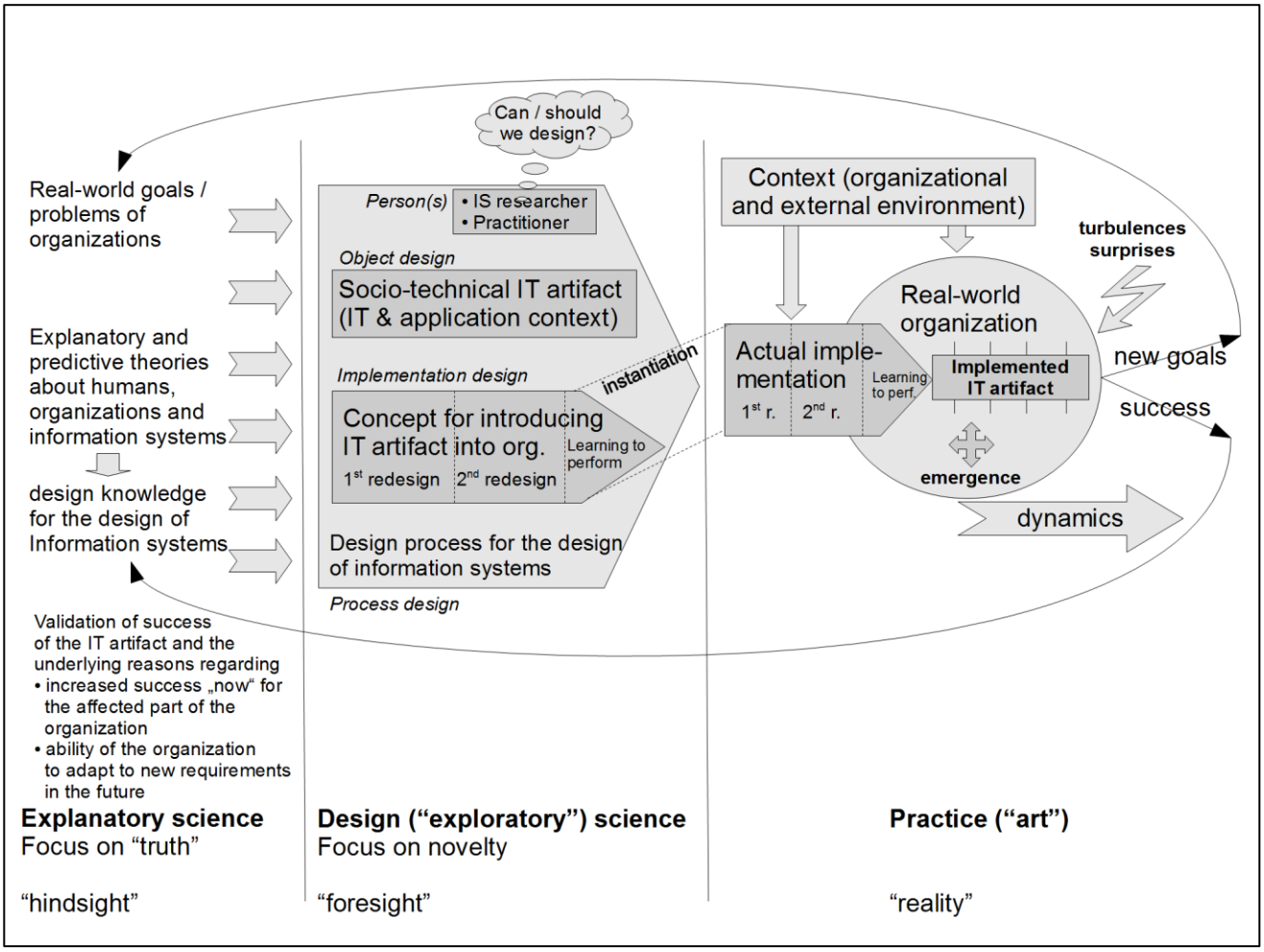

Figure 2: DSR approach by van Aken et al. adapted for the design of socio-technical IT artifacts

Design of management systems for IS/IT management and IT project management

This section shows the potential of the previously outlined management DSR approach to the fields of IS/IT management and IT project management (henceforth called IS management). The structure of this section follows the elements in Figure 1.

Conducting DSR for IS management means designing IS management artifacts that aim to solve real-world problems or goals of IT departments or project teams. Here, the outcomes of typical topics of IS/IT management research (business IT alignment, IT governance, IT service management, etc.) or project management research provide abstract, potential solutions for classes of these problems. In addition, the necessity to formulate explicit problems or goals at the start of a design effort can uncover IS management issues faced by practitioners that have not been tackled yet by IS management research.

As outlined in the section beginning with "Current state of DSR in the management field", explanatory theories form the major source of input for the design process. For IS management research, this includes conceptual papers and empirical studies about IS/IT management and project management topics. However, as also mentioned in the same section, a tautological transformation of explanatory research outcomes into CIMO design rules is of little use. Gregor and Hovorka (2011) provide a framework of different types of causality in different types of research settings (and, hence, theories). While this issue cannot be covered in more detail at this point, note that explanatory theories tend to rely on different types of causality than DSR. Therefore, a simple "interchange" of causal input-output(IO-)rules and the aforementioned heuristic CIMO design rules is not possible when grounding design decisions on empirical findings from IS management research. Thus, if there are as yet no empirically-validated design rules for a specific problem, such design knowledge needs to be developed first, before actual artifacts can be designed on the foundation they provide.

Journal of Information Technology Theory and Application

Because the design process is problem- or goal-driven, it is also explicitly necessary to include the designer(s) in the approach because their perceived problems and their personal goals drive the whole design effort. Potential designers here include researchers, managers, and consultants in the area of IS management. Venkatesh (2008) regards the actors or actions in the IS design science debate as "under-socialized" and sees the designer(s) of a social system as an agent. As a result of this agency issue, designers might, for example, further their own interests through the design instead of pursuing organization-related goals. A further challenge arises due to the possibility that the persons who design abstract IS management artifacts are not necessarily the same who implement an instantiated artifact in a specific IS management organization in practice. In this case, methods regarding stakeholder management (e.g., from software requirements engineering) can be a worthwhile addition to the design process. The question "Can/should I design?"—paraphrased from Tranfield et al. (2006) and depicted in Figures 1-3—is also a relevant one to keep in mind for IS management design efforts. Pries-Heje et al. (2008) call this "artificial ex-ante evaluation" of an artifact.

An object design resulting from a DSR approach to IS management consists of a model of future organizational reality (or parts thereof) of an IS management organization. Depending on the underlying problem, it may contain elements of, for example, an IS strategy, the organizational structure of the IT department or the project management organization, IS management or project management processes, or IT infrastructure for IS management purposes. The corresponding implementation design is about designing actions for "change management", which, for an IS management artifact, can include both organizational elements (establishing a project management organization, changes in IS management processes, training of IT staff, etc) and technical elements (customizing of IS management software, its integration into the infrastructure, etc). Because this area is arguably the least specific for applying the generic design science approach to the area of IS management, there are several examples from the management research literature that can be drawn on to illustrate the role of DSR for organizational change and development (see Bate (2007) for an overview).

The instantiation in practice now forms the bridge between science and the "art" of IT managers and consultants to instantiate and adapt an abstract object design artifact and the corresponding implementation design artifact to the specific context in practice. The major challenge for IT managers and consultants is to account for the "uniqueness" of every IS management organization (as related to both the social and the technical elements of the socio-technical system the IS management organization comprises). From a researcher's perspective, this also means a lack of control over the application of an abstract object design artifact and therefore the potential end of the "chain of rigor" throughout the entire design process. To remedy this lack of control, Carlsson et al. (2010) propose a collaboration of design science researchers with consultancy firms in order to support a controlled transfer of management DSR outcomes (= artifacts) into practice and the subsequent evaluation of the instantiated artifacts.

Evaluating an IS management DSR project's success needs to be context specific due to the general problem- or goal-orientation of the whole approach. Any success or failure can be attributed to the abstract object design's or the abstract implementation design's (in)adequacy, the inadequacy of their instantiations in practice, and/or the whole effort's underlying goals. Still, a thorough evaluation of each design instantiation is necessary to scientifically progress the designed IS management artifact, the underlying theories, and the methods employed during the design process. In the end, the evaluation's results can lead to a confirmation or revision of the object design, the implementation design, the design process, and/or the underlying theoretical foundations in the form of design rules or descriptive theories.

Figure 3 (based on Figure 1) shows a visual summary of the management DSR approach applied to DSR for IS/IT management. An application to DSR for IT project management would follow similar lines and lead to a rather similar outcome. For this reason, it is not displayed in a separate figure.

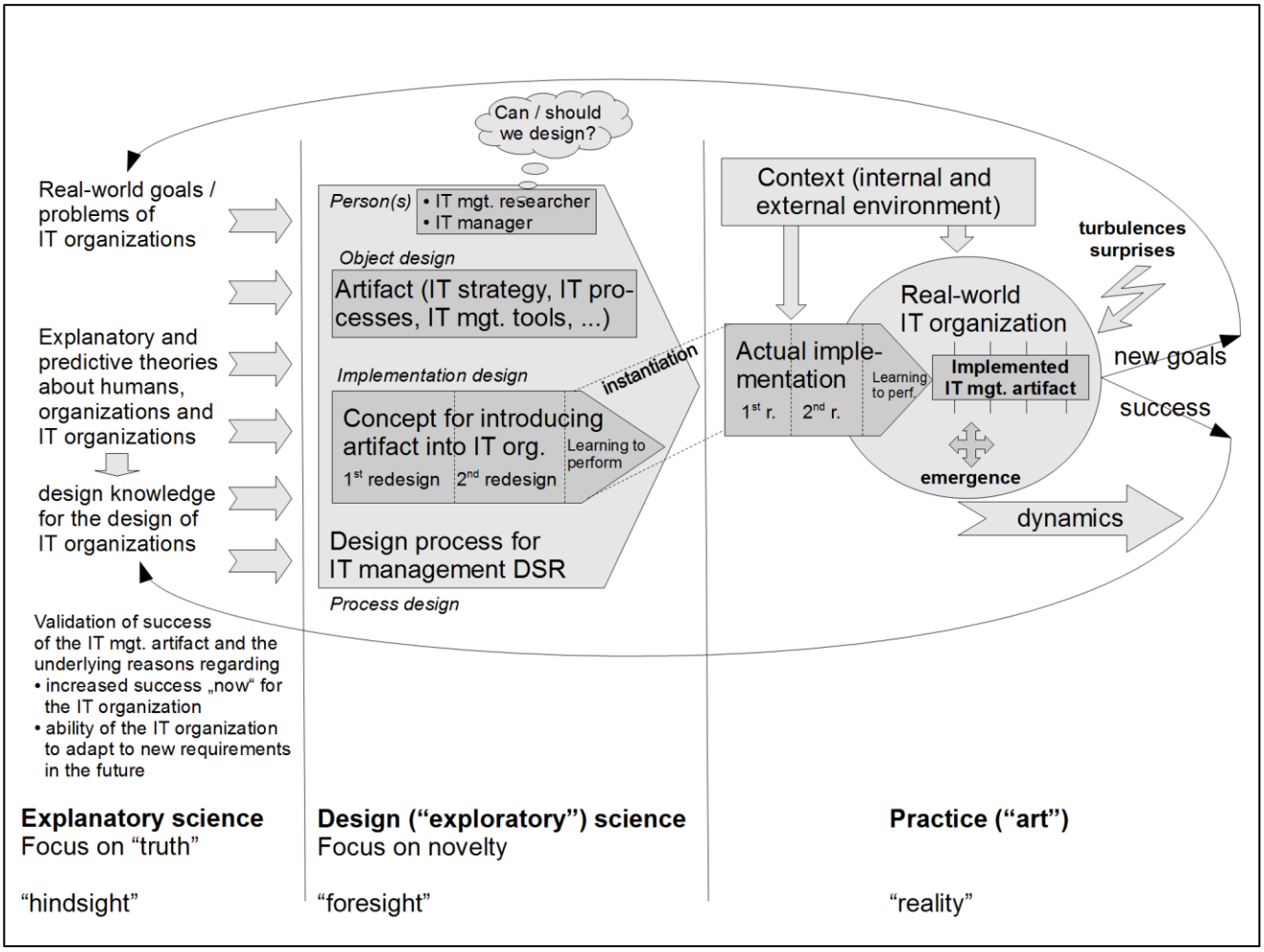

Figure 3: DSR approach by van Aken et al. adapted for the design of IS/IT management organizations

DISCUSSION AND LIMITATIONS

Applying the management DSR approach to the field of IS in the previous sections allows a shift of perspective for traditional IS DSR from IT artifact design toward designing information systems in organizations. It also shows a way to conduct DSR for the domains of IS/IT management or IT project management. For traditional IS DSR, this specifically means a broader perspective in design objects beyond IT artifacts toward organizations as socio-technical systems that are complex, dynamic, and impossible to fully grasp for both (potential) designers and researchers. This different nature of design objects is also reflected in extending the design metaphor beyond an "engineering-like" interpretation toward path-dependent and path-creating DSR outcomes. At the same time, the management DSR approach retains the general idea of designing abstract artifacts. This allows design science researchers utilizing the approach to draw on common DSR literature from the IS field and beyond (going back to Simon (1996), for example). A further strength of artifact-centric design is the development of a coherent "entity" during design time. In addition, it allows researchers to differentiate clearly between an abstract design product and its instantiation. It furthermore allows them to differentiate between an object design artifact representing a possible future organizational reality and an implementation design artifact as means to instantiate and customize the object design artifact.

The transfer from the management DSR discourse to IS DSR conducted in the section "General contributions to the DSR discourse in IS" was made possible due to a large extent of compatibility of each field's literature. Their compatibility further validates the current state of the IS DSR discourse, especially since there were no contradictory findings in the corresponding discourse in the management field. At the same time, I show that my findings concerning artifact relevance (conceptual, instrumental, legitimative), the nature of management artifacts, and different types of design (deterministic, path-dependent, and path-creating) further inform the IS discourse. Differentiating between conceptual and instrumental relevance re-iterates the importance of differentiating between abstract artifacts and instantiations since the respective outcomes ask for a different relevance assessment. Management DSR also places special emphasis on the context-dependent and non-deterministic nature of a DSR

JOURNAL OF INFORMATION TECHNOLOGY THEORY AND APPLICATION

process. While Hevner et al. (2004) also speak of DSR as a search process, they do not make it explicit that different search processes occur in parallel on the abstract level and on the level of each instantiation. Due to the volatile nature of organizations and their context the search processes on the instance level are not even ones necessarily aimed at a fixed goal or target (as is typically assumed in deterministic engineering-like design). In management DSR, this non-deterministic perspective on DSR extends to the actual introductory process of an instantiated artifact into a specific context, or, as Romme (2011) calls it: artifaction. He also contributes to a broader perspective on artifacts: the proposed re-definition of the term artifact in DSR as "social fact" going far beyond, and at the same time including, the concept of IT artifacts.

Further, note that, while the summarized approach for management DSR itself is not strictly prescriptive, it can be used more like a framework for IS DSR where researchers need to choose (and justify) individual methodical support for each task or step in an IS DSR project. This "hybrid" nature between method and framework is not discussed explicitly in the management literature—in fact, as the section beginning "Current state of DSR in the management field" shows, a comprehensive summary necessitated the citation of quite a few sources. Therefore, the more general term "approach" is used in this paper to describe it. At the same time, this hybrid nature constitutes a strength for its actual application to IS DSR.

Whether the approach is applied to 1) DSR projects concerning information systems in organizations with an IT artifact as core or to 2) DSR projects for an IS/IT organization or IT project organization is of course going to affect the actual natures of the artifacts and the methods researchers can and should employ. Differentiating the natures of artifacts, relating the extant literature on DSR research methods to the two types of DSR projects, and developing novel research methods, where necessary, lies outside the scope of this paper and is a task for future research. While DSR projects of the latter case are mainly about conducting management DSR with little to no focus on IT artifacts, the respective domains of IS/IT management and IT project management are usually seen as key parts of the IS—and not the management—field.

Furthermore, we should view the elements of this distinction between IT-artifact-centric DSR and organizational DSR, which the paper makes mainly for structural and illustrative purposes, as two extreme points on a continuum. It is conceivable that even DSR projects driven by initially exclusively organizational concerns may incorporate IT artifacts as supplementary tools to achieve organizational goals. In these cases, even a nested application of the management DSR approach (with a different theoretical body of knowledge, artifact types, and methodological support on each level) is possible. This illustrates the inter- and trans-disciplinary nature of the IS field. More specifically, it illustrates that a management DSR endeavor can easily evolve into—or contain—an IS DSR endeavor, which effectively blurs the lines between these two fields. It also exemplifies the difficulty in clearly delineating technical and social / organizational aspects, but in this case in the context of DSR. If one accepts an almost inseparable link between an IT artifact and its application context as socio-materialists propose, an integrated perspective of IS DSR can serve as the first step toward conducting IS DSR in a way that explicitly acknowledges and covers this issue.

Also, the perspective on organizational DSR (representing one extreme point on the continuum just mentioned) is just intended as a general umbrella term. Even just based on the two application contexts (IS/IT management and IT project management) for organizational DSR discussed so far, DSR for IS/IT management organizations (with an emphasis on repeatability, stability, and process efficiency) and IT project organizations (which are established for a limited time, to reach a specific goal, and to deal with novel challenges) will necessitate artifacts with at least some different qualities. Such a view cannot be pursued in the scope of this paper, but opens up a variety of new possibilities for DSR in these two areas, both regarding generic methodical and instrumental support and actual applications.

However, the presented approach for management DSR is not without its limitations. Its underlying problem- or goal-oriented attitude excludes identification of "breakthrough" (i.e., novel) problems, goals, or issues through research, which indicates that it should be deliberately supplemented by suitable research approaches capable of arriving at novel research questions. Because there are no suitable, sufficiently comprehensive modeling languages yet for modeling future realities of social systems, it can be necessary to specify the organizational part of the object and implementation design in potentially ambiguous natural language and simple diagrams. The issues of the instantiation of the artifacts in practice being more an art than a science and the difficulties of clearly attributing success to the various elements (theory, design rules, object design, implementation design) and levels (abstract artifacts, instantiations, organizational or technical elements of the artifacts) are already highlighted in the sections above. In addition, current methodical support for evaluation in IS DSR focuses on the evaluation of IT artifacts (see (Peffers et al. 2012) for an overview). Due to the extended perspective of the management DSR approach beyond the IT artifact, it may be necessary to adapt and refine the methodological body of IS DSR evaluation methods for an application to management DSR.

CONCLUSION AND OUTLOOK

Drawing on the current DSR literature in the management field, this paper presents a comprehensive DSR approach for management artifacts. The paper shows that the approach is usable for DSR in the IS field for designing both IT artifacts / information systems (which are part of organizations) and management systems (such as organizational structures or processes) for IS/IT management or IT project management. It provides a change of perspective for IS DSR with a shift away from an IT-artifact-centric perspective toward a perspective of the design of information systems in organizations, with or without an emphasis on information technology. For future research, there are a multitude of opportunities for actually applying the approach to suitable areas of IS research, for evaluating it and refining it further, and for developing adequate methodical support for each part of the approach that takes the extended DSR perspective beyond IT artifacts into account.

ACKNOWLEDGMENTS

An earlier version of this paper was presented at the DESRIST 2012 conference and is published in the conference proceedings: Drechsler, A., "Design Science Research as Design of Social Systems – Implications for Information Systems Research" In *Design Science Research in Information Systems: Advances in Theory and Practice: 7th International Conference, DESRIST 2012, Las Vegas, NV, May 2012, Proceedings (LNCS 7286)*, Peffers, K., M. Rothenberger, B. Kuechler (eds.), Springer, Heidelberg, pp. 191–205.

The author wishes to thank Frederik Ahlemann, the three anonymous DESRIST reviewers, and the two anonymous JITTA reviewers for their helpful comments about earlier versions of this papers.

REFERENCES

Ahlemann, F. and H. Gastl, "Process Model for an Empirically Grounded Reference Model Construction," In *Reference Modeling for Business Systems Analysis*, Fettke, P. and P. Loos (eds.), IGI Publishing, Hershey, PA, 2007, pp. 77–98.

Allen, B.R. and A.C. Boynton, "Information Architecture: In Search of Efficient Flexibility," *MIS Quarterly*, 1991, 15:4, pp. 435–445.

Alter, S., "Sidestepping the IT Artifact, Scrapping the IS Silo, and Laying Claim to 'Systems in Organizations,'" *Communications of the Association for Information Systems*, 2003, 12:1, pp. 494–526.

Avenier, M.-J., "Shaping a Constructivist View of Organizational Design Science," *Organization Studies*, 2010, 31:9/10, pp. 1229–1255.

Bate, P., "Bringing the Design Sciences to Organization Development and Change Management Introduction to the Special Issue," *Journal of Applied Behavioral Science*, 2007, 43:1, pp. 8–11.

Benbasat, I. and R.W. Zmud, "Empirical Research in Information Systems: The Practice of Relevance," *MIS Quarterly*, 1999, 23:1, pp. 3–16.

Benbasat, I. and R.W. Zmud, "The Identity Crisis within the IS Discipline: Defining and Communicating the Discipline's Core Properties," *MIS Quarterly*, 2003, 27:2, pp. 183–194.

Bennis, W.G. and J. O'Toole, "How Business Schools Lost Their Way," *Harvard Business Review*, 2005, 83:5, pp. 96–104.

Bunge, M., *Scientific Research II: The Search for Truth*, Berlin: Springer, 1967.

Carlsson, S.A., "Developing Knowledge Through IS Design Science Research: For Whom, What Type of Knowledge, and How," *Scandinavian Journal of Information Systems*, 2007, 19:2, pp. 75–86.

Carlsson, S.A., "Design Science Research in Information Systems: A Critical Realist Approach," In *Design Research in Information Systems: Theory and Practice*, Hevner, A. and S. Chatterjee (eds.), Springer, New York, 2010, pp. 209–233.

Carlsson, S.A., S. Henningsson, S. Hrastinski, and C. Keller, "Socio-technical IS design science research: developing design theory for IS integration management," *Information Systems and e-Business Management*, 2010, 9:1, pp. 109–131.

Davenport, T.H. and M.L. Markus, “Rigor vs. Relevance Revisited: Response to Benbasat and Zmud,” *MIS Quarterly*, 1999, 23:1, pp. 19–23.

Davis, F.D., “Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology.,” *MIS Quarterly*, 1989, 13:3, pp. 319–340.

Denyer, D., D. Tranfield, and J.E. van Aken, “Developing Design Propositions through Research Synthesis.,” *Organization Studies*, 2008, 29:3, pp. 393–413.

Eisenhardt, K.M., “Building Theories from Case Study Research.,” *Academy of Management Review*, 1989, 14:4, pp. 532–550.

Fendt, J. and R. Kaminska-Labbé, “Relevance and Creativity through Design-Driven Action Research: Introducing Pragmatic Adequacy,” *European Management Journal*, 2011, 29:3, pp. 217–233.

Fettke, P., C. Houy, and P. Loos, “On the Relevance of Design Knowledge for Design-Oriented Business and Information Systems Engineering - Conceptual Foundations, Application Example, and Implications,” *Business & Information Systems Engineering*, 2010, 2:6, pp. 347–358.

Frank, U., *Organising the Corporation: Research Perspectives, Concepts and Diagrams*, University of Koblenz-Landau, Germany: Research report No. 25 of the Institute of Business Information Systems, 2001.

Frank, U., “Die Konstruktion möglicher Welten als Chance und Herausforderung der Wirtschaftsinformatik,” In *Wissenschaftstheorie und gestaltungsorientierte Wirtschaftsinformatik*, Becker, J., H. Krcmar, and B. Niehaves (eds.), Physica-Verlag HD, Heidelberg, 2009, pp. 161–173.

Frank, U., C. Schauer, and R. Wigand, “Different Paths of Development of Two Information Systems Communities: A Comparative Study Based on Peer Interviews,” *Communications of the Association for Information Systems*, 2008, 22:1, pp. 391–412.

Galliers, R.D., “Change as Crisis or Growth? Toward a Trans-disciplinary View of Information Systems as a Field of Study: A Response to Benbasat and Zmud’s Call for Returning to the IT Artifact,” *Journal of the Association for Information Systems*, 2003, 4:1, pp. 337–351.

Garud, R., S. Jain, and P. Tuertscher, “Incomplete by Design and Designing for Incompleteness,” *Organization Studies*, 2008, 29:3, pp. 351–371.

Garud, R., A. Kumaraswamy, and V. Sambamurthy, “Emergent by Design: Performance and Transformation at Infosys Technologies,” *Organization Science*, 2006, 17:2, pp. 277–286.

Gibbons, M., H. Nowotny, and C. Limoges, *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, London: Sage Publications, 1994.

Gregor, S., “The nature of theory in information systems,” *MIS Quarterly*, 2006, 30:3, pp. 611–642.

Gregor, S. and R. Baskerville, “The Fusion of Design Science and Social Science Research,” *Information Systems Foundations Workshop, Australian National University, Canberra*, 2012, .

Gregor, S. and A.R. Hevner, “Positioning and Presenting Design Science Research for Maximum Impact,” *MIS Quarterly*, 2013, 37:2, pp. 337–A6.

Gregor, S. and D. Hovorka, “Causality: The Elephant in the Room in Information Systems Epistemology,” *Proceedings of the ECIS 2011 Conference, Helsinki*, 2011.

Gregor, S. and D. Jones, “The Anatomy of a Design Theory,” *Journal of the Association for Information Systems*, 2007, 8:5, pp. 312–335.

Grey, C., “Re-imagining Relevance: A Response to Starkey and Madan,” *British Journal of Management*, 2001, 12:S1, pp. S27–S32.

Hevner, A., “A Three Cycle View of Design Science Research,” *Scandinavian Journal of Information Systems*, 2007, 19:2, pp. 87–92.

Hevner, A., S.T. March, J. Park, and S. Ram, "Design Science in Information Systems Research," *MIS Quarterly*, 2004, 28:1, pp. 75–105.

Hodgkinson, G.P., P. Herriot, and N. Anderson, "Re-aligning the Stakeholders in Management Research: Lessons from Industrial, Work and Organizational Psychology," *British Journal of Management*, 2001, 12, pp. S41–S48.

Hodgkinson, G.P. and D.M. Rousseau, "Bridging the Rigour–Relevance Gap in Management Research: It's Already Happening!," *Journal of Management Studies*, 2009, 46:3, pp. 534–546.

Hrastinski, S., S. Carlsson, S. Henningsson, and C. Keller, "On How to Develop Design Theories for IS Use and Management," *Proceedings of the ECIS 2008 Conference, Galway, Ireland*, 2008.

Iivari, J., "A Paradigmatic Analysis of Information Systems As a Design Science," *Scandinavian Journal of Information Systems*, 2007, 19:2, pp. 39–64.

Iivari, J. and J. Venable, "Action Research and Design Science Research – Seemingly similar but decisively dissimilar," *Proceedings of the ECIS 2009 conference, Verona*, 2009.

Kieser, A. and L. Leiner, "Why the Rigour–Relevance Gap in Management Research Is Unbridgeable," *Journal of Management Studies*, 2009, 46:3, pp. 516–533.

Kock, N., P. Gray, R. Hoving, H. Klein, M.D. Myers, and J. Rockart, "IS Research Relevance Revisited: Subtle Accomplishment, Unfulfilled Promise, or Serial Hypocrisy?," *Communications of the Association for Information Systems*, 2002, 8:1.

Kuechler, W. and V. Vaishnavi, "The emergence of design research in information systems in North America," *Journal of Design Research*, 2008, 7:1, pp. 1–16.

Kuechler, W. and V. Vaishnavi, "A Framework for Theory Development in Design Science Research: Multiple Perspectives," *Journal of the Association for Information Systems*, 2012, 13:6, pp. 395–423.

Lassing, N., D. Rijsenbrij, and H. van Vliet, "How well can we predict changes at architecture design time?," *Journal of Systems and Software*, 2003, 65:2, pp. 141–153.

Leonardi, P.M. and S.R. Barley, "Materiality and change: Challenges to building better theory about technology and organizing," *Information and Organization*, 2008, 18:3, pp. 159–176.

March, S.T. and T.J. Vogus, "Design Science in the Management Disciplines," In *Design Research in Information Systems: Theory and Practice*, Hevner, A. and S. Chatterjee (eds.), Springer, New York, 2010, pp. 195–208.

McKay, J. and P. Marshall, "Science, Design, and Design Science: Seeking Clarity to Move Design Science Research Forward in Information Systems," *Proceedings of the 18th Australasian Conference on Information Systems, Toowoomba*, 2007.

Nicolai, A.T., "The Bridge to the 'Real World': Applied Science or a 'Schizophrenic Tour de Force'?," *Journal of Management Studies*, 2004, 41:6, pp. 951–976.

Nicolai, A.T. and D. Seidl, "That's Relevant! Different Forms of Practical Relevance in Management Science," *Organization Studies*, 2010, 31:9/10, pp. 1257–1285.

Nunamaker, Jr., J.F. and R.O. Briggs, "Toward a broader vision for Information Systems," *ACM Trans. Manage. Inf. Syst.*, 2012, 2:4, pp. 20:1–20:12.

Orlikowski, W.J. and C.S. Iacono, "Research Commentary: Desperately Seeking the 'IT' in IT Research—A Call to Theorizing the IT Artifact," *Information Systems Research*, 2001, 12:2, pp. 121–134.

Pandza, K. and R. Thorpe, "Management as Design, but What Kind of Design? An Appraisal of the Design Science Analogy for Management," *British Journal of Management*, 2010, 21:1, pp. 171–186.

Pawson, R., *Evidence-based policy a realist perspective*, London; Thousand Oaks, Calif.: SAGE, 2006.

Pawson, R. and N. Tilley, *Realistic Evaluation*, London: Sage, 1997.

Peffers, K., M. Rothenberger, T. Tuunanen, and R. Vaezi, "Design science research evaluation," In *Proceedings of the 7th international conference on Design Science Research in Information Systems: advances in theory and practice*, Peffers, K., M. Rothenberger, and B. Kuechler (eds.), Springer, Berlin, Heidelberg, 2012, pp. 398–410.

Peffers, K., T. Tuunanen, M. Rothenberger, and S. Chatterjee, "A Design Science Research Methodology for Information Systems Research," *Journal of Management Information Systems*, 2007, 24:3, pp. 45–77.

Pettigrew, A.M., "Management Research After Modernism," *British Journal of Management*, 2001, 12:S1, pp. S61–S70.

Pries-Heje, J., R. Baskerville, and J. Venable, "Strategies for Design Science Research Evaluation," *Proceedings of the ECIS 2008 conference, Galway, Ireland*, 2008.

Romme, A.G.L., "Making a Difference: Organization as Design.," *Organization Science*, 2003, 14:5, pp. 558–573.

Romme, A.G.L., "Organizational Development Interventions: An Artifaction Perspective.," *Journal of Applied Behavioral Science*, 2011, 47:1, pp. 8–32.

Rosseau, D.M., "Envisioning Evidence-Based Management," In *The Oxford Handbook of Evidence-Based Management*, Rosseau, D.M. (ed.), Oxford University Press, New York, 2012, pp. 3–24.

Sarasvathy, S.D., "Causation and Effectuation: Toward a Theoretical Shift from Economic Inevitability to Entrepreneurial Contingency," *Academy of Management Review*, 2001, 26:2, pp. 243–263.

Sarasvathy, S.D., "Making It Happen: Beyond Theories of the Firm to Theories of Firm Design," *Entrepreneurship: Theory & Practice*, 2004, 28:6, pp. 519–531.

Sarasvathy, S.D., N. Dew, S. Read, and R. Wiltbank, "Designing Organizations that Design Environments: Lessons from Entrepreneurial Expertise," *Organization Studies*, 2008, 29:3, pp. 331–350.

Sein, M., O. Henfridsson, S. Purao, M. Rossi, and R. Lindgren, "Action Design Research," *MIS Quarterly*, 2011, 35:1, pp. 17–56.

Simon, H.A., *The Sciences of the Artificial*, Cambridge, Massachusetts: MIT Press, 1996.

Starkey, K. and P. Madan, "Bridging the Relevance Gap: Aligning Stakeholders in the Future of Management Research," *British Journal of Management*, 2001, 12:S1, pp. S3–S26.

Strong, D. and O. Volkoff, "Understanding Organization-Enterprise System Fit: A Path to Theorizing the Information Technology Artifact," *MIS Quarterly*, 2010, 34:4, pp. 731–756.

Tranfield, D., D. Denyer, and P. Smart, "Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review," *British Journal Of Management*, 2003, 14:3, pp. 207–222.

Tranfield, D., A. Huff, and J.E. Van Aken, "Management as a Design Science Mindful of Art and Surprise.," *Journal of Management Inquiry*, 2006, 15:4, pp. 413–424.

Van Aken, J.E., "Management Research Based on the Paradigm of the Design Sciences: The Quest for Field-Tested and Grounded Technological Rules," *Journal of Management Studies*, 2004, 41:2, pp. 219–246.

Van Aken, J.E., "Management Research as a Design Science: Articulating the Research Products of Mode 2 Knowledge Production in Management.," *British Journal of Management*, 2005, 16:1, pp. 19–36.

Van Aken, J.E., "Design Science and Organization Development Interventions.," *Journal of Applied Behavioral Science*, 2007, 43:1, pp. 67–88.

Van Aken, J.E. and A.G.L. Romme, "A Design Science Approach to Evidence-Based Management," In *The Oxford Handbook of Evidence-Based Management*, Rosseau, D.M. (ed.), Oxford University Press, New York, 2012, pp. 43–61.

Venkatesh, M., "On Social Design," *Procedings of the ICIS 2008 conference, Paris*, 2008.

Walls, J.G., G.R. Widmeyer, and O.A. El Sawy, "Building an information system design theory for vigilant EIS," *Information Systems Research*, 1992, 3:1, pp. 36–59.

Weick, K.E., “Theory Construction as Disciplined Imagination.,” *Academy of Management Review*, 1989, 14, pp. 516–531.

Williams, B.J. and J.C. Carver, “Characterizing software architecture changes: A systematic review,” *Information and Software Technology*, 2010, 52:1, pp. 31–51.

ABOUT THE AUTHOR

Andreas Drechsler is post-doctoral researcher at the Institute of Computer Science and Business Information Systems at the University of Duisburg-Essen in Germany and holds a doctoral degree from the same institution. His research focuses on understanding and enhancing current practices in areas of IS/IT management (such as IT service management or IT governance) and IT project management (such as agile methodologies or the acceptance of project management methodologies in general). A further research interest concerns the development of design science research methods and methodologies to conduct rigorous design-oriented research in the two aforementioned areas. The results of his work have been presented on several international conferences.

JITTA

JOURNAL OF INFORMATION TECHNOLOGY THEORY AND APPLICATION

JITTA is a Publication of the Association for Information Systems
ISSN: 1532-3416